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ABSTRACT

Part of the postsecondary educational system in Canada, community colleges offer several types of programs to both students leaving the secondary system and adults who want occupational training or education in the applied arts and human service professions. Like other educational institutions, these two-year colleges have sought to use new technologies both in administration and in teaching and learning. Analyses of the 99 responses received from a survey of 169 colleges conducted in 1983 show that educational film and television and, to a lesser extent, broadcast radio and audiocassettes, are being used in subjects ranging from sports to science, education, and numerous vocational trades. Additionally, nearly 90% of the colleges have or are developing policies and guidelines for the introduction and use of computers in the classroom. Teleconferencing, videotex, satellites, and interactive video are used to a lesser extent, primarily because of the cost of the technology. The survey questionnaire and a list of responding colleges are included. (4 references) (DB)

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NEW TECHNOLOGIES IN CANADIAN EDUCATION

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PAPER 3

COMMUNICATIONS AND INFORMATION TECHNOLOGIES IN COMMUNITY COLLEGES IN CANADA

By Sandra Campbell Budden

Study Coordinator
Ignacy Waniewicz

August 1984

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NEW TECHNOLOGIES IN CANADIAN EDUCATION

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Paper 2	Communications and information technologies in Canadian elementary and secondary schools
Paper 3	Communications and information technologies in community colleges in Canada
Paper 4	Communications and information technologies in Canadian universities
Paper 5	Communications and information technologies and distance education in Canada
Paper 6	Communications and information technologies and the education of Canada's native peoples
Paper 7	The provincial educational communications organizations in Canada
Paper 8	Educative activities of the Canadian Broadcasting Corporation and the National Film Board of Canada
Paper 9	Applications of new technologies in nonformal adult education in Canada: Two examples
Paper 10	Canadian cable television and education
Paper 11	Educational applications of videotex/Telidon in Canada
Paper 12	Educational applications of communications satellites in Canada
Paper 13	Educational videodisc in Canada
Paper 14	Educational teleconferencing in Canada
Paper 15	Telehealth: Telecommunications technology in health care and health education in Canada
Paper 16	The high technology industry and education in Canada
Paper 17	New technologies in education in Canada: Issues and concerns

Copies of these papers can be purchased from TVOntario, Box 200, Station Q, Toronto, Ontario, Canada M4T 2T1.

FOREWORD

We dedicate this series to its designer and director, Ignacy Waniewicz. His death on February 21, 1984, has left us with a feeling of immeasurable loss.

With uncanny intelligence, instinct, and energy, Ignacy introduced the first educational television programs in his native Poland in 1957 and rose to the position of Director of Educational Broadcasting. During the mid-1960s, he served as a Paris-based program specialist in the educational use of radio and television, working for UNESCO in Chile, Cuba, Ivory Coast, Upper Volta, Mexico, Egypt, Nigeria, Senegal, Ghana, Great Britain, United States, Switzerland, and Israel. Ignacy shared the experience and insight he gained from this work by teaching and writing in Polish, German, Russian, Hebrew, Spanish, French, and English. His achievements are widely recognized in the broadcasting and academic communities on four continents.

As Director of the Office of Development Research at TVOntario, Ignacy explored his farsighted and consuming interests in adult education, media literacy, television as a primary tool for lifelong learning, and most recently, the educational uses of new technologies. His work did much to shape and guide TVOntario's progress over the last 15 years.

It is with love and respect that we dedicate this series to Ignacy Waniewicz. In its enormous scope, its thorough documentation, its emphasis on concrete results, and its concern with educational issues, this series reflects both Ignacy's vision and his intellectual legacy.

Donna Sharon
for the Office of Development Research

Preface to the Series

NEW TECHNOLOGIES IN CANADIAN EDUCATION

These papers in the series "New Technologies in Canadian Education" are the result of an international commitment. In June 1980, the Third Conference of Ministers of Education of Member States of the European Region of UNESCO adopted a recommendation requesting the member states to carry out joint comparative studies on well-defined problems of common interest in education. At a subsequent meeting of the European Region National Commissions for UNESCO, 14 subjects were agreed on for joint studies.

The theme "New Technologies in Education" was selected as study #11. The 17 countries participating in the study are Austria, Belgium, Denmark, Finland, France, Hungary, Italy, the Netherlands, Poland, Spain, Sweden, Ukrainian SSR, USSR, United Kingdom, as well as Canada, Israel, and the U.S.A. who are also members of the UNESCO European Region. At the first meeting of the national coordinators from these countries, held in October , 1982, at the University of South Carolina in Columbia, South Carolina, U.S.A., a plan was adopted for the study. In the first phase of this plan, the individual countries are to report on the ways in which the new technologies are being used in education. (A brief outline of the international design is available on request.)

The Canadian Commission for UNESCO was requested to coordinate, on an international level, the first year of the study. We are grateful to the Canadian Commission for selecting TVOntario, and the Office of Development Research (ODR) to be in charge of this task. The ODR was also asked to coordinate the Canadian contribution to the study, with financial support from the Department of the Secretary of State. We gratefully acknowledge their assistance.

In preparing the Canadian review of the use of technology in education, the ODR contacted a number of educators, academics, government officials, administrators in educational communications organizations, and others, across the country. It became apparent that there was a strong need for a well-documented account of the uses of both the "older" technologies (e.g., film, audio, television) and the newer technologies (e.g., computers, videodiscs, videotex) in the complex Canadian educational system.

Early in 1983, several types of research activities began simultaneously: designing instruments to gather information from each type of institution or interest group, identifying uses and users of each type of technology, and exploring the areas where Canada's distinctive features predispose toward technological developments. The 17 papers listed on the back of the title page emerged as a result.

Information for these papers was provided by hundreds of individuals expressing their own views or reporting on behalf of educational institutions and organizations, government departments, public and private corporations. We extend to them our sincere thanks.

I would like to acknowledge the contribution made by Thelma Rosen who assisted in the development of the inquiry instruments and played a major role in the gathering of this information. The task of supervising the final editing, production, and distribution of the papers was assigned to Donna Sharon. Her resourcefulness and persistence have contributed greatly to the completion of this series. Sharon Parker typed most of the papers from the initial drafts to their final versions. Her dedication made it possible to complete the study in such a relatively short period.

While the preparation of these papers has been supported by the Canadian Commission for UNESCO and the Department of the Secretary of State, the papers' contents do not necessarily reflect the official views of either party on issues related to technology in education.

Ignacy Waniewicz
Study Coordinator
Director
Office of Development Research
TVOntario

January 1984

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INTRODUCTION

The community college system in Canada

Community colleges in Canada are part of the postsecondary system of education, which extends beyond Grade 11 in Quebec, Grade 13 in Ontario, and Grade 12 in the other provinces and territories. In 1982-83, over 290,000 students were enrolled in full-time credit programs in Canada's 196 community colleges. Although there are no nationwide figures available for part-time enrollment, the Association of Canadian Community Colleges estimates that there are six part-time for every full-time enrollment which indicates a total of over 1,700,000 enrollments in part-time studies.

The growth in community colleges took place largely between 1960 and 1970. Some colleges emerged from the transformation of local trade institutes during the federal government's expansion of vocational and technical training programs. Others, such as those in Saskatchewan, emerged as a result of community pressures for increased educational services. Still others, such as the system of Collèges d'enseignement général et professionel (CEGEP) in Quebec and the community colleges in Ontario, emerged as part of a deliberate plan to expand and reorganize the entire educational system of the province.

There is diversity in the governing structures of Canada's community colleges. In all provinces except New Brunswick and Manitoba, the colleges are operated by a board of governors which reports to the appropriate provincial ministry. In some provinces, board members are appointed partly by the province and partly by the municipality in which the college operates. Colleges in New Brunswick and Manitoba are governed directly through ministries of education as are several colleges in Nova Scotia. In British Columbia, members are appointed by the Ministry of Education.

The colleges offer several types of programs. They serve the educational needs of students leaving the secondary system as well as those of adults who want occupational training in technological, commercial, or industrial areas, or education in the applied arts and human service professions. Credit and noncredit courses are offered to

adults enrolled in continuing education programs. In Quebec, the colleges prepare students for entry into university. In Alberta and British Columbia specified credits earned in the colleges can be accepted as university credit.

While all provinces have at least one college that offers technical and trade education, the range and type of courses offered in the colleges vary across Canada. The colleges offer two- to four-year diploma courses; federal government funded employment training courses; one-year certificate programs; weekend workshops; and short noncredit courses. Course offerings in the colleges are influenced by the needs of industry, professional groups, and trade unions, by provincial requirements for certification in various occupations, and by federal funding policies for training programs.

The scope of the study

Like other educational institutions, colleges have sought to use new technologies in administration and in teaching and learning. This paper describes some of the ways in which technologies are used in teaching and learning in community colleges across Canada today. Consideration is given to the policies and initiatives that govern acquisition and present and future applications; to the impact of these technologies on curriculum and methods of delivery; and to teacher roles and responsibilities. The changing nature and quality of community college education as a result of educational technologies are discussed in the final section.

In the Spring of 1983, questionnaires were mailed to the 169 members of the Association of Canadian Community Colleges. The questionnaire was prepared jointly by the Office of Development Research of TVOntario and the Association of Canadian Community Colleges. Two copies of the questionnaire were sent to each college - one to be completed by the president and one by the college's expert on information technology. Responses were received from 70 anglophone and 29 francophone colleges. In this paper, the term "francophone" is used to describe those colleges in the provinces of Quebec, New Brunswick, and Ontario that function in French; "anglophone" refers to those that function in English. The colleges that function in both official languages are categorized to according to their dominant

language of instruction. These responses served as the basis for a draft of this paper, a copy of which was mailed to all of the 169 presidents for additional comments in June 1984. Forty-two colleges responded to this request, and this paper contains information from both sets of responses. The questionnaire used to collect the original data is reproduced in Appendix I and a list of responding colleges is provided in Appendix II.

This paper begins with a description of the use of the established technologies of film, television, and radio both by themselves and in combination with the computer and other technologies. The second section describes applications and innovations that have occurred as a result of the introduction of computers, videotex, teleconferencing, satellites, and videodisc.

FILM, TELEVISION, AND RADIO

In many provinces, the growth of the community colleges occurred during a period when considerable attention was being given to the potential benefits of film, television, and radio for teaching and learning. It is not surprising to discover at least one of those technologies in use in every college. Film and television and, to a lesser extent, broadcast radio and audiocassettes are being used in subjects ranging from sports and recreation to hospitality services, science, engineering, mathematics, education, and numerous trades.

Applications of film, television, and radio

Film is widely used in a variety of subject areas. Film projectors and screens are classified as standard equipment in colleges.

Television, whether broadcast, cable, or videotape, also is widely used by colleges, and ranks a close second to film in frequency of use. The use of broadcast television is limited by broadcasting times which often cannot be coordinated with class scheduling.

Cable television was frequently cited by the respondents as the delivery medium for many courses, particularly those of community interest. Such courses often use learning materials such as workbooks, texts, and reading lists. The respondents for New Brunswick Community College, Woodstock Campus, report that "cable television will allow us to expand and produce programs of a local community nature." Keyano College in Alberta also uses a local cable network for educational programs, as does Assiniboine Community College in Manitoba.

In Quebec, a consortium of 13 educational institutions has been formed to provide programming via cable television to audiences in the regions of Montreal, Quebec City, Chicoutimi, Rimouski, Hull, Sherbrooke, and Trois Rivières. Each community has been allotted time on a specialized educational cable channel. In Montreal and Quebec, educational programming is available on this channel 24 hours

per day. In other communities, the channel is dedicated to the regional member of the consortium for four or five hours per day.

In Ontario, the community colleges' Committee of Presidents, comprising 22 member colleges, has cooperated with TVOntario in purchasing from the United States a series called The New Literacy: An Introduction to Computers. In return for its contribution, each college receives 26 half-hour videotapes, a telecourse study guide, and a faculty manual that suggests ways of working with distance learners and setting tests. The colleges receive faculty guides to hands-on application classes, which are closely related to the video and print materials. TVOntario broadcasts the series as well.

Fraser Valley College in British Columbia reports that smaller operating budgets are forcing colleges into acquiring fewer films and substituting videotapes, which can be purchased for approximately 40 to 60 per cent of the cost of films. In addition, Fraser Valley faculty often prefer using videotape because of its flexibility. Equipment is more portable, easier to use, and quieter, there is good image retention in still pictures, and individual frames can be selected for classroom discussion and student assignments.

Radio is still used, but on a much smaller scale than film and television. While it is the least expensive of the broadcast technologies, its use is limited by broadcasting schedules. This limitation can be overcome by using audiocassette recordings of programs. Audiocassettes are often used in distance education and correspondence courses, usually in conjunction with print materials.

College policies on these technologies relate to the allocation of funds for the purchase of equipment such as videotape recorders, players, cameras, and film projectors, rather than to directions on their use in teaching and learning. The absence of policies concerning the way in which these technologies are used indicates that decisions about their use are seen as the professional responsibility of individual instructors.

Both the anglophone and francophone colleges use all of these technologies extensively, although the subject areas in which they are used vary. In anglophone colleges the most

frequent use occurs in business courses, with nursing second. In the francophone colleges, the most extensive use occurs in the humanities, followed by the social sciences, business, physical education, and nursing. In foreign-language instruction, anglophone colleges report extensive use of audiocassettes, while francophone colleges favor the use of film and television.

The colleges report a continuing need for program material in the high-use areas. As Capilano College in British Columbia reports, "All areas desire instruction materials in other than print form." The anglophone colleges in particular report a need for material in some of the newer areas of instruction, such as electronics, food technology, robotics, artificial intelligence, air traffic control, nuclear medicine, and data processing. The francophone colleges do not mention these areas to the same degree.

There is a lively interest in the challenge of discovering and implementing new approaches in the application of these media. Many colleges report the existence of committees to research the issue of new applications and to provide suggestions and proposals for new initiatives. Among these colleges are Mohawk and Cambrian in Ontario, Matane in Quebec, and Bay Saint George in Newfoundland. Technical specialists have been hired to develop new uses for audio and audiovisual media by Collège André Grasset and Collège Montmorency in Quebec. Marianopolis College in Quebec reports that it is "constantly in touch with technological developments in the a/v field" and that "contact is kept with distributors to provide students with flexible and sophisticated aids."

The Department of Community Colleges in New Brunswick reports that "a very great deal of effort and money has been and continues to be spent on individualized multimedia learning packages" intended primarily for trades and business-related training. The production of print and audiovisual materials and, more recently, instructional software for these learning packages is done in-house and coordinated by the Curriculum Division of the Department of Community Colleges. Teachers are seconded for extensive periods of time to participate in developing these packages.

Seneca College in Ontario pioneered the use of independent, student-centred study labs using mixed media at

its Centre for Independent Learning. Seneca sells much of its educational material to Canadian community colleges; for example, Northern College in Ontario reports that its Kapuskasing Campus uses these materials extensively. Colleges across the country now have similar student-centred labs. The Northern Alberta Institute of Technology reports that it supports the development of innovative applications of media and computers in teaching and learning because the college believes that these applications provide alternate delivery modes which enable it to expand and enhance its services to the community.

Production sources

Most colleges engage in some in-house production of audiocassettes and videocassettes; however, when the decision is made to purchase film, television, or audio materials, a number of different anglophone colleges use American sources extensively; the francophone colleges tend to use Quebec-produced materials.

In the anglophone colleges, the primary source of videotape cassettes is American commercial and educational producers. In-college productions rank second, followed by programming from independent Canadian producers, TVOntario, the provincial ministries, the Canadian Broadcasting Corporation, and the National Film Board. In the francophone colleges, Radio-Québec is the primary source of videotape programs, followed closely by in-college production, the Canadian Broadcasting Corporation, and the National Film Board.

The National Film Board is the primary source of films for all colleges. In addition, the anglophone colleges rely heavily on American commercial and educational producers, unlike their francophone colleagues who use programs from independent Canadian producers, the Canadian Broadcasting Corporation, Quebec and New Brunswick ministries of education.

All colleges report that in-house production is the primary source of audio programming for education. The anglophone colleges use Canadian Broadcasting Corporation as their second source; the francophone colleges use programming produced by the Quebec Ministry of Education.

Teacher training

Most colleges support and enhance the use of film, television, and radio in teaching and learning by offering some kind of staff training in the operation of equipment and the integration of audiovisual materials into classroom techniques. The ways in which the training is offered vary considerably from college to college.

Some training, such as that offered in the Newfoundland colleges, is entirely self-directed and is available on videotape and audiocassettes from library media centres. Other training is offered in short workshops that form part of pre-service training for new teachers. Training in audiovisual use is included in the curriculum of teacher certificate courses in three western colleges and two Quebec colleges. As well, some colleges offer a variety of voluntary in-service workshops during the college year and the summer months. Two Quebec colleges mention no training of any kind, and one states that "very few [teachers] have benefited" from its existing training program.

Media awareness

The term "media awareness" refers to a critical understanding of the characteristics and applications of the print, audio, and audiovisual media in use today. Courses in media awareness provide training in the terminology and the potential applications and implications of each medium, and examine such important issues as the political, social, economic, and artistic influence and power of media.

Two-thirds of the francophone colleges and one-half of the anglophone colleges offer courses in media awareness. An average of approximately 10 to 20 per cent of the full-time student body is enrolled. Most participants come from communications courses; the others are drawn from business administration, health, psychology, and library techniques. The exception to this is Collège de Sécrétariat Notre Dame in Quebec, which reports that 90 per cent of its students participate in a media awareness course.

Integrated applications

Some applications integrate film, television, and radio with computers and other technologies. A project at Lethbridge Community College in Alberta combines the computer with television and slides for interactive instruction. Other colleges (such as Northern Lights Community College in British Columbia, Red Deer Community College in Alberta, Centennial College and Seneca College in Ontario, and New Brunswick Community College) have created individualized learning packages containing print, videotape, and computer-based learning materials. Algonquin College in Ontario combines an independent learning package (print and audiotape) with computer-based evaluation to enable students to learn basic library skills.

Sheridan College's Interactive Video Design Centre has combined videotape and print with the Apple II microcomputer to create several individualized interactive video learning packages for students in visual arts. In contrast to a linear classroom presentation of video material, this method enables the student to determine how the video will be delivered. Sheridan has formulated a set of design and production criteria for the packages, and has begun work on a service unit that will teach the principles of interactive video design and help evaluate proposed applications of computer-managed, video-interfaced instruction.

Clearly, community colleges across Canada make extensive and varied use of film, television, and radio. The allocation of funds to purchase equipment and to explore and develop innovations demonstrates that they will not be eclipsed by the advent of the new computer-based technologies; instead, new ways of integrating them will be found.

COMPUTER TECHNOLOGY

Policies on acquisitions and applications

Government policies. The developments in computer technology, and particularly in microcomputing, have been so rapid that all institutions find themselves scrambling to respond to new developments reactively rather than proactively. Current federal and provincial government policies govern the acquisition of hardware or software rather than their specific use.

Education is a provincial responsibility in Canada, but federal funding arrangements have an impact on the nature of college offerings, particularly in occupational training. In 1982, the federal government established the Skills Growth Fund (SGF) to try to alleviate the serious shortages of skilled workers in specified technologies and trades. The fund's purpose is to provide money to the colleges through provincial ministries for the establishment, conversion or expansion of facilities to provide training in occupations that have been identified and designated as suffering either national, widespread, and persistent shortages or regional or industrial shortages serious enough to constitute a national problem. The SGF provides capital funding and, under certain circumstances, contributes to initial operating and course development costs.

The infusion of SGF money into the community colleges has been a major factor in the purchase of new hardware and the establishment of state-of-the-art trades and technical training courses. Since its establishment, the SGF has distributed $191.5 million to 305 projects. Some of this money has gone to trade schools and nonprofit private organizations, but the bulk of it has gone to community colleges. For example, this funding led to the recent establishment of Computer-Assisted Design and Computer-Assisted Manufacturing (CAD/CAM) training facilities in numerous colleges across the country; it allowed the purchase of hardware to accommodate training in aspects of electronic engineering, robotics, and data processing; and it provided funds for the creation of new courseware, such as the recent project of the Ontario Consortium of Colleges,

discussed in the section of this paper entitled "Learning with Computers."

In Newfoundland, the government has imposed a "rigid tendering system" governing the purchase of computer hardware and has provided a grant to Bay St. George College to establish a computer education program. In New Brunswick, all purchase requests for computer hardware and software must meet criteria set and evaluated by the Ministry of Education. This Ministry then submits approved requests to the Ministry of Supply and Services which conducts all purchases. Prince Edward Island reports that no government initiatives or policies concerning acquisition have yet been developed. In Nova Scotia, approval of purchases is made by senior management of the Department of Education. Systems and Computer Services coordinates the purchases.

In Alberta, the Department of Advanced Education, which has responsibility for colleges, has no explicit policy governing the acquisition and use of traditional or new information technologies. However, the Department established the Educational Technology Advisory Group (ETAG), which facilitates the collaborative planning, development, and use of technology in the postsecondary system. ETAG draws its membership from representatives of all provincial postsecondary institutions, government, and the private sector.

In British Columbia, mainframe computer acquisition must be approved by the British Columbia Systems Corporation, a crown corporation; there are no provisions governing the purchase of micros or support equipment. At present, only two types of hardware are used in the British Columbia colleges - IBM and DEC. In the opinion of one college, this ensures "portability of software" among the colleges.

Saskatchewan requires central review of computer-related acquisitions only for administrative uses. Educational applications are increasing, and there is a move toward central coordination of purchase of hardware and software for educational purposes.

College policies. The respondents indicate that there is strong management support for providing education and training that accurately reflect the state of the art in

computer technology and the present applications of computers in the work world. There is also support for developing the use of computers as teaching/learning tools. Nearly 90 percent of the responding colleges have or are developing policies and guidelines for the introduction and use of computers in the classrooms; over one-half have policies regarding the use of computers in distance education. These policies reflect two widely held beliefs; first, students must become computer literate and can only do so by using computers; second, faculty must have a positive attitude toward computers in order to use them successfully in the teaching/learning process.

Although computer literacy is an important goal, most colleges have policies regarding the wider uses of the technology in teaching and learning. For example, John Abbott College, Collège de Saint-Jèrôme, and Collège de Chicoutimi in Quebec have established committees to study the uses of the computer in teaching and Keyano College in Alberta has a Computer Coordination Committee to make recommendations regarding computer literacy, computer-managed learning, and computer-assisted learning. Collège de l'Outaouais in Quebec writes that a research centre for computer applications in education will open in September 1984. The centre will be headed by an educational consultant who will conduct evaluation studies of computer use in learning.

The policy of Mohawk College in Ontario states that "all students must take a computer course to become computer literate." Similarly, Niagara College in Ontario reports that their goal is to provide sufficient introductory computer literacy courses for all students by 1985-86. Other colleges are seeking to ensure computer literacy for adults enrolled in certain disciplines if not for all.

Most of the colleges that have no firm policies on computer use are in the process of developing them. Mistikwa College in Saskatchewan writes that it is taking advantage of studies already conducted by others in order to develop its own policies, while Conestoga College in Ontario reports that it is encouraging its teachers to become involved in the policy-making process.

The acquisition and distribution of computer hardware and software are being handled by colleges in different ways.

Some colleges have established committees to address the issue (Collège de Chicoutimi and Collège de Saint-Jérôme in Quebec). Others, such as Mount Royal College in Alberta, have hired "external consultants" to make recommendations to in-house committees. Still others are engaged in research to determine their own needs before purchasing (Collège de Shawinigan and Collège de Ste-Foy in Quebec, Holland College in Prince Edward Island, and Mohawk College in Ontario).

It seems that vendors of computer hardware play an important role as catalysts in the process of encouraging the use of computers in education, as well as in determining the type of hardware utilized. One respondent (Niagara College in Ontario) writes: "In view of the budgetary constraints, market incentives by vendors heavily influence the selection of hardware within the Canadian college system."

Policies on distribution address two different matters: the physical setting for the equipment and the types of equipment needed for various programs. Physical distribution has been dealt with in a number of ways. At Camosun College in British Columbia and Collège de Matane in Quebec, among others, the equipment is placed in "microlabs" throughout the school. These labs allow for independent study and form part of the Colleges' learning resource centres. At Canadore College in Ontario, all computer teaching is done in one lab. Other schools share equipment. In the case of Wascana Institute of Applied Arts and Science in Saskatchewan, the hardware is located outside the school; the students have access to the mainframe computer through terminals inside the institute.

Some colleges have developed guidelines for the types of equipment to be used in different departments. Humber College in Ontario specifies a minicomputer system for computer-assisted instruction (CAI), a mainframe computer for programming courses, and microcomputers for other programming and technical applications. In other colleges, minicomputers are used to support all computer-based learning.

Applications of computer technology

Computers in teaching and learning are currently being used in nearly all colleges. The few colleges that do not currently use computers attribute their absence to budget problems or to a curriculum that does not yet call for such teaching aids.

A study conducted by Holland College in 1984 provides the most up-to-date information on the distribution of microcomputers and mainframe computers in computer-assisted instruction (CAI) and computer-managed learning (CML) in 131 Canadian community colleges.[1]

Table 1

	Response Number	Breakdown Per cent
Is CAI on your campus available on:		
A. Microcomputers only?	23	37.7
B. Mainframe computer only?	7	11.4
C. Both micros and mainframe?	30	49.3
D. Other	0	0.0
E. No answer	1	1.6
Is CML on your campus available on:		
A. Microcomputers only?	18	39.1
B. Mainframe computer only?	15	32.6
C. Both micros and mainframe?	13	28.3
D. Other	0	0.0

The Apple is the type of microcomputer most commonly used in the anglophone colleges. The Commodore and the TRS-80 are most popular in the francophone colleges. However, both anglophone and francophone colleges use a wide variety of makes of microcomputers. Our respondents indicate that especially in the last year, the IBM PC and its compatibles have been a frequent choice of college purchasers throughout the country.

In the majority of the colleges, about 30 per cent of the students use a computer for at least five hours in the school year. This number is expected to increase in the next couple of years to 50 per cent. The anglophone colleges predict a heavier student use in the next five years than do the francophone colleges.

Learning about computers. Computers and other technologies are creating changes in the content and process of much community college education. The content has been changing as courses are introduced that incorporate learning about the computer. The process by which teaching and learning occur is changing as computer-assisted instruction and computer-managed learning become more widespread in the colleges.

In the last ten years, the most apparent change in curricula has been the introduction of courses in computer literacy, computer science, and business applications of computers. In addition, colleges have decided that technological literacy courses, which provide an overview of the newest scientific and industrial developments, are an important addition to their curricula. Although college personnel recognize the potential of the computer as an instructional tool in many subjects, the emphasis at this time is on courses that teach about computers in general as well as on those vocational subjects which produce students capable of programming, operating, and maintaining computer systems.

The colleges share a belief in the necessity for the computer literacy of all students and staff. One college in Ontario reports that "all college entry within two to three years will require computer literacy." Another respondent, also from Ontario, predicts that soon there will be "a likely requirement of computer literacy for all graduates." However, at present, many entering students, whether recent high school graduates or older adults, have had no experience with computers. The colleges are trying to respond to the need for courses in basic computer literacy.

Computer literacy is now emphasized for science, business, and vocational students, and often these departments are the only ones offering literacy courses. However, many colleges are either suggesting or requiring that all students, regardless of discipline, complete an

introductory computer course. This is the situation at Collège de Bois de Boulogne and Collège de Marie Victoria in Quebec, Mohawk College in Ontario, Newfoundland and Labrador College of Trades and Technology, and Lakeland College in Alberta.

Some community colleges are supporting community outreach projects to offer computer literacy courses to the general public in remote areas. Such initiatives are currently underway in New Brunswick, Alberta, and Manitoba. The Edmundston campus of New Brunswick Community College supports a microcomputer learning centre for all community residents. The centre is open seven days and evenings a week, and residents can book one hour per day, free of charge. The centre is supervised by an instructor, but no formal classes are offered. It is reported that the centre is well used. In Alberta, the North Peace Educational Consortium (of which Fairview Community College is a member) is sponsoring a Compu-Van equipped with 12 IBM PCs and printers. The Compu-Van will travel to communities in northwestern Alberta, offering an opportunity for students in remote communities to engage in hands-on training in computer literacy and some applications programs.

In Manitoba, money from the Skill Growth Fund has been used to purchase two mobile computer trailers, one operating from Assiniboine Community College in Brandon and one from Keewatin Community College in The Pas. These trailers are equipped to provide a variety of computer training, from basic computer literacy for general noncredit education to credit computer courses that are integrated into college certificate and diploma programs. Each trailer is large (4.34 metres by 18.60 metres) and supports 10 IBM PCs. It is expected that more hardware will be acquired, and it is hoped that CAI and CML will be incorporated into the training. The trailer will remain in a community for as long as three to four months at a time.

The demands of the marketplace for employees with skills in the new technologies are also changing college curricula. More than two-thirds of the colleges offer courses in computer science and computer technology (programming, operating, systems analysis, and repair and maintenance). In addition, two-thirds of the colleges offer courses in computer business applications - that is, accounting, word

processing, data processing, inventory control, and small business applications.

Specialized offerings such as Computer-Assisted Design (CAD), Computer-Assisted Manufacturing (CAM), and robotics are also being introduced into college curricula. Such courses have become much more widespread in the past year owing to Skills Growth Fund grants. They are offered primarily to engineering students and people currently employed in industry. In addition, several colleges offer courses dealing with computer use in the service sector, such as computers in the travel industry, computers in pharmacy, and computers in health care. Lakeland College in Alberta predicts that as the computer sophistication of students increases owing to their primary and secondary school education, colleges will take a more active role in the development and delivery of these specialized courses.

It is generally recognized that as computer technology transforms our social, political, economic, and knowledge structures, students will require courses in technology literacy and quantitative reasoning and skills in order to manage these changes. The majority of anglophone and francophone colleges have added such courses to their curricula. Also, many colleges write about initiatives undertaken to meet the challenge of renewing curricula so that they accurately reflect technological developments and current marketplace conditions. Some colleges have established departments or committees to update curricula and to implement the use of computers in learning.

In Ontario, Sheridan College's Research and Development Committee has allocated $250,000 to 40 projects directed by college faculty in the last 18 months. These projects involve the use of computers in innovative educational applications and include interactive video packages for independent study in art fundamentals, an anatomy videodisc, and instructional software introducing computers in the preschool setting. Also, this college has developed two new diploma programs which are unique: Courseware Design and Production, and Telecommunications Management.

Seneca College in Ontario has established the Department of Academic Research, Review and Renewal, which is just beginning its second year of operation. In its first year, 40 projects involving 30 college faculty whose teaching load

was reduced to enable them to become Principal Investigators were initiated. These projects, covering almost every division in the college, involved the use of computers in teaching and learning.

In western Canada there are several projects underway for the purpose of updating curricula and extending the use of educational technologies at the same time. Cariboo College in British Columbia reports the development of a variety of self-paced, modularized learning materials and computer software produced under contract to the Province. Southern Alberta Institute of Technology has pioneered the development and use of computer-managed learning in that province and Northern Alberta Institute of Technology has developed alternate course delivery systems integrating computer-assisted and computer-managed instruction with other educational technologies. The projects of these Alberta colleges are discussed in detail in the following section.

Learning with computers. Both mainframe computers and microcomputers have the potential for several applications in the actual teaching/learning process. Among these are drill and practice, which involve flashcard-type stimulus-response interaction; tutorials, in which textual information is interspersed with questions, branching according to learners' responses; problem-solving, in which learners apply the principles, rules, and logic of science and math to solve problems; simulations, which present models based on reality that allow learners to gauge the consequences of hypothetical "real-life" decisions; simulations of scientific experiments that would be too risky or costly to perform in real life; criterion-based tests, in which questions can be generated at random and test results can be provided immediately; information management, and word processing.

Computer-assisted instruction (CAI) occurs when a student interacts in a conversational mode with a computer that has a pre-programmed study plan. Respondents to the questionnaire indicated that CAI is most frequently used in business subjects, science, English, and mathematics. Many colleges feel that CAI is effective in providing remedial instruction in English and math skills. Computer-managed learning (CML) relieves the teacher of tasks associated with individual and group instruction; for example, keeping records on learner programs, tabulating averages, test-making, and item banking.

Some systems combine the functions of computer-assisted and computer-managed learning. The Holland College study also included a breakdown of CAI and CML use by province.

Table 2. Use of CAI and CML by Province.[2]

Province	Total	Use CAI		Use CML	
		Number	Percent	Number	Percent
British Columbia	19	11	57.9	7	36.8
Alberta	11	8	72.7	9	81.8
Saskatchewan	14	6	42.8	3	22.2
Manitoba	3	2	66.7	1	33.3
Ontario	18	12	66.7	7	38.7
Quebec	49	17	34.7	15	30.6
New Brunswick	10	4	40.0	4	40.0
Nova Scotia	4	1	25.0	0	0.0
Newfoundland	4	0	0.0	0	0.0
Total	131	61	46.0	46	35.1

This same study indicates that 62.3 per cent report using CAI only to a limited degree in a few courses; only 3.3 per cent report using it extensively in 10 or more courses.

The degree to which CML is being used is much higher. While only 35 per cent of the responding colleges report having CML in place, it is more extensively used in those colleges. Of CML users, 17.4 per cent report using it extensively in 10 or more courses; 28.3 per cent use it extensively in under ten courses; and 47.8 per cent use it to a limited degree in a few courses.[3]

The study indicates that Alberta has the highest incidence of CAI/CML use of any province. The reason for this may be the early pioneering work that the Southern Alberta Institute of Technology (SAIT) undertook in CML in the 1970s. The first version was implemented in the Fall of

1976; it has been continuously improved, enhanced, and enlarged since that time, and version four is now in operation. The system was originally developed in 1976 with seed money from Alberta's Department of Advanced Education. It has since been made available to the Northern Alberta Institute of Technology (NAIT), Grande Prairie Community College, Lethbridge, Red Deer and Keyano Colleges, all of which now have the system in place. It is also installed in the College of New Caledonia in British Columbia. Other Alberta colleges, such as Grant MacEwan and Mount Royal, report that they have benefited from SAIT's pioneering work; they support the use of related CML systems for several of their course offerings and project an expansion of CML applications.

The SAIT software is a management system consisting of a database of test items. The software package runs on a Digital Equipment Corporation VAX 11/780 minicomputer. It can also be executed on a VAX 11/750. At present, 200 question banks cover such subjects as electronics, electrical technology, power engineering, civil engineering, math and physics, and emergency medical training. SAIT also delivers its CML to 10 remote sites which communicate with the SAIT computer via phone line or Bell Datapac. The test items are delivered on a printer, and students complete the test in their own time. The computer can mark true/false, yes/no questions and can provide students with their test results instantaneously. Questions requiring essay-type answers are delivered to the instructor for marking.

A color graphics package is now being incorporated into the SAIT CML software package to provide remedial assistance to students encountering difficulties in completing the required learning in a study unit or module. The color graphics present an alternate means of delivering the material to be learned which might be more appropriate to the learning style of the student. The designers of this CML system report that they are working to increase its capacity to provide additional computer-based remedial assistance to students in difficulty. Also, the adaptation of this system for use in a microcomputer environment is being explored.

The absence of appropriate systems software and instructional software has been an impediment to further CAI/CML usage. Seven Ontario colleges have undertaken a cooperative project aimed at developing a large body of

instructional software for skills training in occupations deemed to be of national importance. This project, which is largely funded by the federal Skills Growth Fund ($2.8 million), will result in the installation of hardware for CAI/CML use (the Honeywell DPS 6 minicomputer system) in the cooperating colleges and the creation of instructional software, including interactive video and videodisc. The instructional software created will be appropriate for use in training for the following occupational areas: robotics technician; operator, chemical process unit; systems analyst; electronics engineering technician; welder-fitter; industrial maintenance mechanic; industrial engineering technician; mechanical engineering technician; and industrial electrician.

The seven participating colleges in this project (Canadore, Conestoga, Niagara, Lambton, St. Lawrence, Sault, and Sir Sanford Fleming) have formed a consortium and are considering the use of a common language and operating system called CAN-8. This system was developed by the Department of Measurement, Evaluation and Computer Applications at the Ontario Institute for Studies in Education, which will also act as consultant on the project. A number of Ontario colleges have used the CAN-8 system for several years, and the body of courseware that has already been developed will be made available to the consortium free of charge. The consortium's decision to use a common language and operating system ensures the portability of developed instructional software. The operating system also provides a sophisticated networking capability which will enable the colleges to exchange courseware more easily.

The reported experiences of several colleges indicate that the successful implementation of CAI/CML requires careful advance planning with the consultation and cooperation of administration, faculty, and students. The least successful implementations in terms of frequency of use and user satisfaction were those that focussed on hardware first, software second, and the user third. The overall aims and objectives of the course/program must be well defined; software must be critically evaluated to determine its suitability, and it must be matched to compatible hardware. Colleges are discovering that this process frequently requires the complete restructuring of existing courses.

Holland College in Prince Edward Island provides an example of a studied, phased approach to the implementation of computers in teaching and learning. To provide a framework for future computer use in the college, staff have been encouraged to become computer literate and to study current trends in education and suggest new strategies that might respond to these trends. The College sponsored a computer-based delivery project which studied the use of CAI/CML in 131 community colleges in Canada.

All courses at Holland College are based on the competency model of learning. This model is a performance-oriented approach to instruction that is particularly appropriate to occupational education. In this system, each occupation for which education is to be provided is analyzed to define the competencies required for successful performance in that occupation. The knowledge, skills, and attitudes implicit in these competencies are then incorporated into units of study, which students complete at their own pace. The College is developing a computer database containing lists of the competencies required in each program. This database will facilitate course revisions, thus ensuring the relevance of course material to the realities of the work world. Also, the database will provide a new delivery system for course modules. In addition to these program competency lists, the College is developing an individualized competency list to assist staff members in their continuous professional development.

The Northern Alberta Institute of Technology (NAIT) has successfully developed and implemented an innovative model of program design and delivery which integrates several traditional educational technologies such as print, video, and slides with CAI and CML. This project, funded by the Alberta Department of Advanced Education, demonstrates how integration transforms the traditional teacher-led classroom process of education into self-paced training with full computer management. The eight-week program is for second-year students in the Electrician Apprenticeship Program. Program content is contained in 70 print-based modules which students are required to complete successfully at their own pace and in their preferred sequence. The CML system enables the student to take a pretest for each module to diagnose his or her learning needs and to engage in computer-based evaluations of each module. All records of student progress are instantly available to the instructor and the student.

The program designers, aware of the high cost of creating quality instructional software, used CAI only as a last-resort alternative to facilitate learning in those theory 'hot spots' that were identified as creating the most difficulty for students. The ability of the computer to enable students to build "what-if" scenarios and to run simulations was used to facilitate learning in these difficult areas. Eight hours of courseware were created.

The traditional classroom is elminated; all the students (30 in this case) spend their time in one large room which is subdivided into areas for labs and terminals, print resource materials, audiovisual viewing, computer-managed learning with print terminals, and computer-assisted learning with video display terminals.

The role of the instructor in this learning environment is as important as it is in a traditional classroom environment but it is different. The teacher becomes a tutor whose help is available to individual students when they encounter difficulties in proceeding through the different modules. The tutor, rather than specializing in one subject area, must be able to help students in all subject areas in the program. Knowledge of learning processes and styles is also necessary for effective tutoring.

The technology as applied in the NAIT program has not de-personalized the learning; rather, it has facilitated the development of closer instructor/student communication. In addition, students voluntarily participate in small informal work groups which meet to solve problems in specific subject areas. Students who prefer to work alone can proceed at their own pace.

The evaluation of this project revealed that only three per cent of students preferred to return to the traditional classroom mode of instruction. Overall training time was reduced, and all students achieved at least equivalent levels of learning, and one large training centre used less space per student than the traditional classroom model.

The designers of the program provided for extensive staff training and support to aid instructors in their transition to this new environment. Instructors are given formal training in the educational technologies and materials management; and an internship period which enables them to

develop their tutoring skills. The College expects that this program design and delivery system will serve as a model for the development of programs in other vocational areas and at other training sites in Alberta.

Software

> "It is clear that designing, developing, testing, producing and distributing high quality courseware is difficult and expensive."[4]

There are many problems associated with instructional software. Colleges have learned from experience that the development of software for educational use is well behind the development of computer hardware and that what does exist often lacks educational quality. Learning and cognitive theory are still not well enough defined to permit design of a programmed system that would be useful for every kind of learning style or environment. Much instructional software is based on rote or highly linear modes of teaching that often are not appropriate. In addition, it is becoming clear that the production of appropriate instructional software requires many skills, including knowledge of the subject area, logical thinking, patience, time, expertise in the programming language, and operable and available equipment. Graphics design ability is sometimes necessary as well. While there are authoring systems that require relatively less expertise, a good understanding of computer operations is still important. When the appropriate software is available, it may not be compatible with college hardware. All of these factors present challenges to the colleges to which they are responding in a variety of ways.

Some colleges have allocated funds or released faculty to pursue research and development projects on learning with computers. Some of these projects, such as that at Cariboo College in British Columbia, have led to the production of instructional software which is then made available for purchase.

Those colleges which support in-house production of instructional software ensure that authoring systems are available for easy staff use. Such software is available for use with minicomputers as well as microcomputers. Algonquin College in Ontario writes that one of its faculty members has

developed a program to teach the CAN-8 authoring language which will be available for purchase. Mount Royal College in Alberta reports staff workshops using software that teaches how to write instructional software for the Apple. In addition, these colleges supporting in-house production report the existence of collaborative user-groups which provide technical advice to members engaged in instructional software development.

Sheridan College, which has been extensively involved in software production through its research and development projects, uses the team approach. The development team includes a content specialist, a specialist in instructional design and production, and a programming specialist.

Some colleges have decided not to support in-house production of instructional software. The respondent from the Nova Scotia Land Survey Institute writes: "Programming should be left to programmers with the user simply making sure the programmer understands very clearly what the results of his or her work should be." Similarly, Pacific Marine Training Institute says: "Good software will only be produced by experienced professionals in the software production business."

Software selection is not being left to chance. Many colleges report software committees made up of faculty, administrators, and department heads. In addition, some have hired full- or part-time specialists to help in the selection or adaptation of existing materials.

The mechanisms established by Centennial College in Ontario to select and evaluate software are similar to those in other colleges across the country. Here, a Computer Steering Committe made up of academic and administrative representatives from across the College oversees all academic and adminstrative uses of the computer. The Computer Steering Committee bases its decisions on the information supplied by the Academic Computer Management Advisory Committee composed of users. The latter Committee maintains an inventory of software within the college and creates an annual software "wish" list based on input from all faculty which is then given to an external consultant for evaluation.

Other colleges rely on the assessments of user groups and software information exchanges among the colleges. In

Ontario, the CAN-8 Users' Group, made up of people from colleges across the province, meets regularly to discuss issues of common concern and to present new instructional software. In addition, some colleges report the existence of in-college user groups which meet to exchange information and solve problems.

In British Columbia, the Provincial Educational Media Centre, funded by the Department of Education, serves as an important vehicle for the dissemination of critical information on educational software. Its monthly publication, Evaluations: Microware, reviewed over 300 pieces of educational software last year and expects to evaluate 400 to 500 software packages this year, which will cover all educational levels from primary to postsecondary.

In western Canada, there are agencies that secure reduction in software costs through bulk purchasing. In British Columbia, a consortium of lower mainland colleges cooperates in the purchase of larger software packages and services. The British Columbia Provincial Educational Media Centre is establishing a bulk purchasing program for educational software. In Alberta, ACCESS, the provincial educational communications authority, will act as a bulk purchasing agent for postsecondary institutions beginning in the Fall of 1984. The Corporation will purchase four times annually. In a recent trial project, ACCESS secured a bulk purchase price of $9,000 on software items that would have cost $54,000 if purchased on an individual basis.[5]

It is not surprising that production sources differ between francophone and anglophone colleges. The francophone colleges produce most of their own software in-house, while the anglophone colleges tend to rely on the computer manufacturers and American educational producers. Collège de Sherbrooke reports that in the last year and a half the college has been involved in software production in collaboration with the Quebec Ministry of Education. This production includes simulations and tutorials, and covers calculus, anthropology, economics, and health sciences. The Community College of New Brunswick in Bathurst reports that it has translated software into French in order to ensure uniformity of content for its anglophone and francophone students.

Other less frequently used production sources cited by the respondents include Canadian commercial producers and provincial educational communications authorities, such as Radio-Québec, and ACCESS Alberta. In addition, the francophone respondents name the Quebec Ministry of Education as an important source.

Distribution of software within the colleges occurs in different ways, depending on the computer systems that the college supports. A computer service department delivers software for the mainframe and mini systems, and learning resource centres distribute software for the microcomputers. Many colleges have cataloguing systems that facilitate software distribution. Between one-third and one-half of the colleges report some sort of courseware cataloguing system, while about one-quarter are establishing instructional software clearinghouses within their institutions.

Teacher training

There is a common desire in the colleges to create the positive teacher attitude essential to the successful use of computers in teaching and learning. While teachers are not being forced to undertake computer-related activities, they are being provided with opportunities to learn and become involved and are being rewarded for doing so.

Dawson College and CEGEP de Sept-Îles in Quebec, St. Clair College in Ontario, and others write that they try to provide micros to staff members to pursue computer-based projects. The latter college reports that it cannot keep up with staff requests for equipment. The Nova Scotia Agricultural School says that all departments have micros and can acquire software as needed. Teachers are being encouraged to use the technology voluntarily at the Southern Alberta Institute of Technology and Humber College in Ontario, and are being asked to avail themselves of opportunities to become knowledgeable about existing hardware and software. Some colleges offer professional development seminars. Major teacher training programs are underway or are being planned at Collège de Ste. Foy, CEGEP de Sept-Îles, and Collège de Lèvis in Quebec, Fairview College in Alberta, and many others.

In Ontario, Seneca College recently conducted a five day "live-in" seminar on microcomputers for administration, teaching, and support staff. The seminar was so successful that a second-level seminar was introduced. The college expects that these seminars will be refined and repeated. At Sir Sanford Fleming College, also in Ontario, a PACLAB has been established which contains several different makes of microcomputers for faculty to use in their own self-paced professional development. The respondent writes: "It is hoped that the comfort level established through the use of this facility will apply to the use of computers within other areas of the college."

In New Brunswick, the Department of Community Colleges has been responsible for a major training initiative in the last year to enable both faculty and support staff to develop skills in high technology. The Instructor Training Program, which is compulsory for all new teaching staff, includes a section on computers in education, and the annual staff conference presents workshops on computers in education.

In Manitoba, Red River Community College offers a one-credit course, Introduction to Computers in Education, in its certificate program for community college teachers. It is expected that a new course, Individualized Competency-Based Learning, will be offered soon.

In Alberta, Mount Royal College inaugurated the use of its new microcomputer learning centre by initially restricting its use to faculty and staff so that they could become fully conversant with the educational potential of the technology. Staff members are being offered training through formal workshop sessions on general and subject-specific topics, or through self-paced instruction on a drop-in basis. In addition, staff members are able to borrow microcomputers and software for home use during the summer months. The centre has purchased an interactive videotape, which links a videotape player to a microcomputer, for teacher instruction in the preparation of software for Apple IIs.

Lethbridge Community College, also in Alberta, has a mandatory Instructional Certificate Program for new and recently hired instructors. One of the required courses teaches the use of traditional audiovisual material. An optional course focussing on new technology includes three

weeks of full-time, hands-on experience in course design. Approximately 20 per cent of the college faculty were involved in this new course and reported a high degree of positive response.

A projected evaluation study may provide information on effective strategies for training staff in the educational use of the computer. The consortium of seven Ontario colleges referred to in the section entitled "Learning with computers" has undertaken a research project to evaluate different strategies to be used in training staff in the use of computers in teaching and learning. The study will include participants who have already demonstrated some interest in computer-assisted instruction as well as some who have not.

The impact of computers on the colleges

Budgetary, physical, and organizational changes are often necessary to create the capacity to take full advantage of the computer as a teaching/learning tool.

The introduction of computers into the colleges has required that the colleges find or reallocate funds for their purchase. All colleges would like more hardware of all types, and many report difficulty in finding enough money to meet their needs. Bay St. George College in Newfoundland reports that students are frustrated by the lack of available equipment. On the other hand, Olds College in Alberta cautions against responding to perceived needs too quickly because of the high costs involved.

Colleges are faced with the reorganization and reallocation of existing space in order to house their new equipment. The peripherals, such as printers, graphic tables, and modems are expensive but essential. In addition, it is often necessary to purchase air-conditioning systems for mainframe and mini environments, special lighting, security systems, and appropriate furniture. Once installed, computer equipment often increases operating costs; for example, one college reports that the installation of a robotics training facility increased its annual operating costs by $50,000. All these changes involve the colleges in expenditures of time, money, and space. Many college respondents report that finding enough of each is a challenge.

College structures are expected to undergo further changes resulting from the introduction of computers. It is generally perceived that the time and place of course delivery have to change. Colleges face the need to reorganize class scheduling to ensure optimum use of computer facilities. It is suggested that the distinctions between full- and part-time students will disappear (Conestoga College) and that distance education should function on a non-semestered schedule.

The skills, roles, and responsibilities of faculty members will also have to change. Faculty will not only need to use the computer flexibly and creatively, but will also need to understand its application in business and industry in order to be able to modify course content appropriately. Ongoing faculty training and support are needed to achieve this. In addition, it is felt that the duties of faculty must be redefined to allow adequate time for them to respond to change; it takes time to redefine course content, to explore appropriate course designs and learning resources for students, and to develop or select quality courseware for the computer.

APPLICATIONS OF OTHER TECHNOLOGIES

Applications for teleconferencing, videotex, satellites, and videodisc are underway or planned in many Canadian colleges. It seems that the most extensive use and development of these technologies is occurring in the anglophone colleges. The francophone colleges have very few projects currently in place, although several are considering future involvement. Collège André-Laurendeau writes it is at the "awareness" stage and does not yet need these technologies for its present curricula. Table 3 reproduces the responses to Part II, question 14 (a), in our questionnaire.

Table 3

Part II, Question 14 (a)

Is your college involved in the development or application of any of the following technologies?

	Anglophone	Francophone
a) Telidon - videotex format	24	2
b) Telidon - teletext format	8	--
c) Videodiscs	14	1
d) Communications satellite	16	--
e) Teleconferencing (audio/video/ computer)	35	2
f) Interactive cable	8	1

Teleconferencing

A teleconference occurs when three or more people in two or more separate locations communicate with one another via telecommunications links. In recent years, teleconferencing has been introduced in several distance education settings to provide direct personal interaction between learners and teachers in different locations.

There are four types of teleconferencing. Audio-teleconferencing is telephone conferencing between three or more participants. Participants can be provided with graphic, written, or video support materials in advance. Audio-plus refers to the addition of several audiographic techniques, such as electronic blackboard, slow scan video images, and videotex, which involve the delivery of printed and graphic material over telecommunications lines. Video-teleconferencing is one-way or two-way, full-motion video which provides participants with moving pictures and sound simultaneously. Computer teleconferencing allows two or more persons to communicate by computer. Messages from one participant can be stored until another participant is ready to receive them.

Over 30 colleges now report using some version of teleconferencing. Audio-teleconferencing with visual supports such as slides, print, overhead transparencies, and videocassettes is the most common form because it is the least expensive.

The most extensive use of teleconferencing is occurring in community colleges in British Columbia, Alberta, Saskatchewan, and Manitoba. Recent government initiatives regarding access to toll-free telephone lines in Manitoba and Alberta are expected to expand teleconferencing in those provinces considerably.

In Manitoba, distance education is considered an important means of extending facilities for adult training and skills upgrading. The Manitoba government has recently funded the acquisition and installation of a province-wide audio-teleconferencing network which will be available for use by postsecondary institutions in that province. The network will be coordinated by the Department of Education, Postsecondary, Adult and Continuing Education Division. The Department will also provide money for distance education course development with priority being given to certain skills areas.

In Alberta, there is extensive use of teleconferencing at the postsecondary level. It is reported that there are 212 teleconferencing sites.[6] Operational costs are high in Alberta because of distances between sites, so the Department of Advanced Education will contribute to the cost of a reduced-rate telephone line. In addition, the government

lines set up for public access to government services will be available after 16:30 hours for toll-free teleconferencing. Seven colleges operate teleconference courses: Southern Alberta Institute of Technology (SAIT), Red Deer College, Grant MacEwan, Lakeland, Olds, Lethbridge, and the Alberta Vocational College.

Confederation College in northern Ontario makes extensive use of audio-teleconferencing. There are 37 courses taught by teleconference at 12 community learning centres. Students are provided with print material, including a study guide, text and test book as well as film, slides, videotapes, and audiotapes. Students meet at their community learning centre on a weekly basis and engage in group discussion on course issues followed by an hour-long teleconference with the instructor.

The College of Trades and Technology in Newfoundland writes: "...17 vocational schools and colleges are connected via a teleconference network. The network is used for both educational and administrative activities. This College is preparing to deliver selective courses to the rest of the provincial vocational scene this coming academic year. The network is being used to deliver applicable university credit courses for in-service teacher-training for our College and Vocational School instructors."

Videotex/Telidon

Videotex is an electronic medium for information transmission, one format of which is the internationally-accepted Canadian system, Telidon. There are two forms of videotex: two-way or interactive videotex, and one-way broadcast videotex, which is called teletext.

Videotex provides a way to create and store text and high-quality color graphics in a computer. They can then be transmitted to a user via telecommunications links such as telephone, coaxial cable, optical fibre, or satellite. The images are then displayed on a specially adapted television screen or monitor. The viewer interacts with the material using a keypad, following instructions on the screen.

Videotex can be used as an information base around which a course can be designed. Information can be easily updated

and revised and can be displayed graphically. Graphic material can be transferred to other media such as print, color slides, and videotape. Teachers and students can create their own databases or can engage in remote database searches. Teletext can be used as an information system to deliver scheduling information, course updates, a bibliography, a syllabus, or even a course.

Twenty-five anglophone and two francophone colleges report involvement in videotex projects; eight anglophone colleges report involvement in teletext projects. Many of these projects have been extensively funded by the federal government.

Loyalist College in Ontario has a Telidon centre which provides training in Telidon marketing and page creation. In addition, third-year electronics students can specialize in videotex, microprocessors, and telecommunications. A host computer supporting a Telidon database of 10,000 pages is in place, and graphic stations allow for page creation. The College uses videotex for two applications in education: on-line training manuals and specific learning/teaching modules in the technology itself. A teletext system also is used with an information database about the college and its facilities. Sheridan College became involved with Telidon in 1981. Its mandate was to explore and foster the use of Telidon for educational and training purposes. A basic teaching unit on page creation which employs the Telidon system has been completed. Instruction is given in design and editing; the available commands are identified and explained and their use is clarified through exercises and practice. This teaching unit has several applications; it gives students a comprehensive view of videotex systems and effective page creation; it allows program developers and instructional designers to understand how the system can be utilized; and it serves as a general introduction to computer graphics technology. A related project concentrated on determining design criteria for videotex text and graphics.

Algonquin College and Sault College in Ontario are also supporting videotex projects. Sault College and Humber College use videotex graphics as part of their CAL systems.

In Quebec, Collège d'Alma has been involved with videotex since 1982. The College has collaborated with the local

office of the Ministry of Agriculture to create a regional agricultural database for local area farmers, is developing self-teaching modules in nursing techniques, and is producing a curriculum for the training of videotex operators, editors, and page creators. Collège de Matane is researching the potential of videotex for teaching modules in tourism and agricultural management.

Colleges in western Canada are also involved with Telidon technology. Cariboo College in British Columbia has created Telidon pagemaker software for the IBM PC. This is the product of a research and development project undertaken with the expectation of selling the product to recover costs. Lakeland College, on the border of Saskatchewan and Alberta, offers four agricultural courses that include instruction on aspects of the Telidon GRASSROOTS database, a farm informaton system. One short, noncredit course will provide hands-on training on GRASSROOTS use. (See Paper 11 for further discussion of the application of videotex in Canadian education.)

Satellites

A satellite transmits video and audio signals from one point of origin to all locations within its reach, or footprint, that are equipped to receive it. In Canada, with its extensive land mass and its generally sparse population density, satellite technology can eliminate geographical barriers. Unlike telephone or other land-based systems, the costs of satellite transmission do not increase with distance covered. However, access to satellite transmission is very expensive. Sixteen colleges report involvement in the use or development of this technology. (Paper 12 in this series provides a discussion on the educational applications of satellite technology in Canada.)

The Knowledge Network of the West, British Columbia's educational telecommunications authority, was one of the first agencies to experiment with the new technology, and became the first commercial customer of Telesat Canada's service in 1980. At the present time, the Knowledge Network utilizes Canada's Anik C3 satellite.[8]

Satellite availability was critical to the expansion of educational television sources in British Columbia. The

province's size, dispersed population, and mountainous terrain prohibited the development of a broadcast system using traditional technology. The Knowledge Network satellite delivery network distributes programming produced by the province's educational institutions and other production agencies. The resulting arrangement is a distance education learning system which delivers programming in three sectors: instruction, general education, and children's programming.

The Knowledge Network provides the delivery system, but each college takes responsibility for producing its own telecourses, enrolling the students, collecting the tuition, and granting the credit. Program development consulting services are made available by Knowledge Network, but the individual college or institute retains full responsibility for course content and delivery. The government encourages the delivery of credit courses through this system by providing special funding to the colleges. Cariboo College, Camosun College, Northern Lights College, the Open Learning Institute, Kwantlen College, the British Columbia Institute of Technology, the Pacific Vocational Institute, and Fraser Valley College report participation in the Knowledge Network's satellite delivery systems. Northern Lights College, which serves a region in northern British Columbia comprising 400,000 square kilometres, has found its ability to serve its constituents greatly enhanced because of the Knowledge Network. (See Paper 7 for a discussion of the Knowledge Network and other provincial educational communications authorities.)

In Alberta, a satellite-based educational communications service will be implemented in January 1985 through ACCESS, the Alberta Educational Communications Corporation. The multi-educational services transmitted via the Anik C3 satellite will be seen on educational cable channels in urban areas and available in remote areas via Direct Broadcast Satellite (DBS) receiving systems. Guidelines for future developments are not yet finalized but the Corporation hopes to collaborate with the provinces postsecondary institutions to transmit telecourses.[9]

The community colleges in Ontario cooperate with TVOntario in the delivery of telecourses. TVOntario's television signal is beamed throughout Ontario via the Anik C3 satellite and transmitted to viewers by a

comprehensive broadcast and cable network, reaching 93 per cent of Ontario's population. Many of the series used as telecourses are broadcast at least twice a week and the colleges arrange for additional broadcast on local community cable channels as necessary. The colleges supplement their telecourse offerings with on-campus seminars, teleconferencing seminars, and toll-free telephone numbers for faculty contact.

At the New Brunswick Community College in Saint John, a unique proposal has been developed for a program to teach electronic and engineering technology students about satellite technology. The students would build a satellite system to link the three CAD/CAM centres in New Brunswick, as well as additional communications links among the community college campuses. The college is currently in the process of securing funds to implement this proposal.

Videodisc

The laser videodisc is a thin plastic disc that resembles a phonograph record. It can contain both audio and video information, has extensive storage capacity, has excellent random access capability, and can be linked to a microcomputer for interactive learning. Seventeen responding colleges are engaged in projects to assess its potential applications. The results of these inquiries have led to the general conclusion that although the technology does have great potential as an educational tool, the costs associated with the production of discs are too high to make videodisc technology a realistic endeavor. (See Paper 13 for further information on videodisc technology and education in Canada.)

Sheridan College is one of the few colleges that has created a videodisc for use in health science classes. A pilot project has produced a multimedia teaching package on the anatomy of the knee, which includes an interactive videodisc. The students work with a touch-screen terminal and a workbook. It is expected that the Individualization Project of the Department of Measurement, Evaluation and Computer Applications at the Ontario Institute for Studies in Education will create videodiscs for community colleges as part of the skills training software it develops for the recently formed consortium of seven Ontario colleges. Seneca

College also expects to produce a videodisc in the coming year.

In western Canada, the Alberta Vocational College, with technical and distribution support from ACCESS, the Alberta Educational Communications Corporation, has produced two videodiscs. The subjects of these discs are deaf awareness and urinary catheterization. ACCESS reports that it has recently completed a very sophisticated learning package, including a videodisc, which teaches English as a second language. This disc will be available for testing in the Fall of 1984. A rigorous evaluation study is being designed that will include testing sites at colleges in Alberta. ACCESS reports there is extensive interest in this disc.

FUTURE DIRECTIONS

Although information and communications technologies have already had significant impact on the content and nature of college education, it is clear that most colleges expect even more changes in the future.

Generally, the respondents believe that styles of teaching and learning will be transformed, that new technologies will create better education and will allow greater access to higher education to larger numbers of people. However, these optimistic beliefs are tempered by two concerns that are often reiterated. First, the costs of acquiring and implementing new technologies could be prohibitive. Second, faculty may not receive sufficient training and support throughout the transition period and thus may not be able to respond positively and creatively to the transforming effects of technology.

Our respondents share the opinion that the teaching/learning process will change as the role of the instructor is transformed from stand-up teacher to tutor and reinforcement agent, (Wascana Institute of Applied Arts and Sciences, Saskatchewan) or from disseminator of information to facilitator (Kwantlen College, British Columbia). Many predict that the instructor will have more time to spend with students in individual problem-solving or will function as a resource person to guide students working on group projects. In addition, instructors will have to be able to evaluate, select, and possibly modify appropriate instructional software; in some cases they may have to develop it.

Many believe that the computer's capacity for self-paced, individualized instruction, instantaneous feedback, simulated experiences, and sophisticated modelling will allow students more successful learning experiences. The technology also has the potential for continuous updating of information. This is especially helpful to designers of competency-based materials; if the materials are designed with a flexible format, continuous updating of objectives can occur as the need arises.

We have seen that the new technologies allow for the expansion of distance education services and the enhancement

of their quality. This permits the participation of disabled persons, persons living in remote locations, and others who have difficulty attending on-campus classes. Colleges recognize the importance of these developments, and foresee education becoming less place-oriented and less time-bound. Faculty schedules and availability of classroom space will no longer determine when and where classes will be offered.

Malaspina College in British Columbia offers some sobering thoughts on the subject of new technologies and learning: "We need to teach people not just to process information but to think. That has always been the central problem in education. Preoccupation with technology and the ability to process data rapidly, is leading us further away from this central problem."

Concern about the cost of all these changes is frequently expressed. This concern is not unique to colleges in any one geographical area, but seems to be more pronounced in responses from eastern Canada, specifically from Quebec and the Maritime Provinces. Some claim that expenditures on hardware, software, and computer research are decreasing the quality of non-computer courses. There is also a fear that those students who come from computer-rich environments, such as British Columbia and Ontario, may become the new "elite," edging out less fortunate students in the competition for college places and scarce jobs.

Finally, there is a common belief in the value of liberal education, but opinion seems to be divided on its future. There are those who believe that liberal education will provide us with the resources we need to respond and adapt positively to rapid change, and that it must and ultimately will flourish (Mohawk College, Ontario, and Dawson College, Quebec). This view is countered by others who believe that liberal education cannot survive in increasingly computerized and vocationally-oriented colleges. Those of this opinion cite the present funding situation which they believe favors computer-related or technical fields and career-oriented training. One college, Bay St. George in Newfoundland, tempers this outlook by expressing the hope that "eventually the public will seek humanity in the midst of technology and liberal education will be re-emphasized."

CONCLUSIONS

Just as the advent of new technologies has created opportunities for the colleges to fulfill their mandates in new ways, so too it has created new problems and challenges. Currently, the colleges are at various stages of responding to the opportunities and encountering, identifying, and finding solutions to the problems.

The colleges share the view that the opportunities provided by the new technologies rest in their potential to expand the accessibility of education and to enhance the quality of the teaching/learning process. Many demonstrate a desire and an ability to take advantage of this potential. However, there is a keen awareness that in order to take advantage of these opportunities, major changes in all areas of the college must occur. Budget priorities must be redefined and physical and organizational structures must be changed. In addition, faculty and student roles and responsibilities must be re-examined, along with the content of the college offerings. Just as faculty will need support to adjust to changing roles, students will need assistance in developing continuous learning skills that will give them the capacity to respond positively to an ever-changing world. Rather than relying on a teacher and a prescribed text to define what will be learned and how, the student becomes an active agent in his or her own learning. Appropriate learning skills include the ability to consult with faculty and other resource people at various stages of the learning project; to assess one's learning needs; to set learning goals based on those needs; to sort and shift through huge amounts of information and to evaluate and select that which will be helpful. In addition, the student needs to be actively engaged in the evaluation of his or her learning in order to be able to set new and relevant goals for further learning, whether inside or outside the college setting.

There is no doubt that all these changes are difficult, requiring the ongoing learning of all involved, and that they cannot occur overnight. The dilemma is that technology is changing very rapidly, much more quickly than the human ability to respond to it. The respondent from Collège André-Laurendeau recognized this when he wrote: "The most important strategy is to address the great resistance to

change provoked by new technology. Physical change is not a major problem. The major practical problem is to change the mentality."

NOTES

1. Smith, R. Project Manager, Computer-Based Delivery Project. Charlottetown: Holland College, 1984. Unpublished study.

2. Ibid.

3. Ibid.

4. Hawkridge, D. New Information Technology in Education. Baltimore: John Hopkins University Press, 1983, p. 148.

5. Sawchuk, Russ. Associate Director, Instructional Technology Unit, ACCESS, Edmonton, Alberta. Telephone interview, 22 August 1984.

6. Ellis, G. Barry. Advanced Technology Consultant, Olds College, Olds, Alberta. Telephone interview, 9 July 1984.

7. Department of External Affairs. Videotex and Education. Ottawa: Department of External Affairs, 1984, pp. 2-5.

8. Hardwick, W. G. "The Knowledge Network: A Satellite Educational Response to the Geography of British Columbia." Space Communication and Broadcasting, An International Journal. Vol. 2, No. 1, March 1984, pp. 27-32.

9. Schreiner, Michael. Director of Production, ACCESS, Edmonton, Alberta. Telephone interview, 22 August 1984.

APPENDIX I

NEW INFORMATION AND COMMUNICATIONS TECHNOLOGIES
AND THE CANADIAN COMMUNITY COLLEGE

PART I

1. Does your college have any policies, directives or guidelines dealing with the use in the teaching/learning process of any of the following:

	Yes	No	Don't Know
Broadcast television	___	___	___
Cable television	___	___	___
Videotape	___	___	___
Film	___	___	___
Audiocassettes/radio	___	___	___

2. Does your college have any policies, directives or guidelines on budgeting and purchasing of any of the following?

	Yes	No	Don't Know
Television sets/colour TV sets	___	___	___
Videotape recorders/players	___	___	___
Video cameras	___	___	___
Film projectors	___	___	___
Film production cameras	___	___	___
Audiocassette players	___	___	___
Radios	___	___	___

3. Is there continued interest in your college in using and acquiring the above technologies?

Yes	No	Don't Know
___	___	___

If so, which technologies? Please specify.

4. In your estimation, what percentage of instructors in your college use each of these technologies on a more or less regular basis?

Broadcast television	___ %
Cable television	___ %
Videotape	___ %
Film	___ %
Audiocassette/radio	___ %

5. Please list the subjects and programmes in which these technologies are used on a more or less regular basis in your college (including for continuing education, distance education, and general interest courses).

	Television/ Videotape	Film	Audio/ Radio

6. Is there a continuing demand for programming in these technologies?

Yes	No	Don't Know
___	___	___

If yes, please indicate the programme areas where there is such a demand.

7. Please indicate which of the following sources produce at least 10% of the programming for these technologies.

	Television/ Videotape	Film	Audio/ Radio
a) In-college	___	___	___
b) Provincial Ministry	___	___	___
c) Ministries in other province(s)	___	___	___
d) TVOntario	___	___	___
e) Radio-Québec	___	___	___
f) ACCESS Alberta	___	___	___
g) Knowledge Network	___	___	___
h) Télé-université	___	___	___
i) CBC	___	___	___
j) National Film Board	___	___	___
k) Canadian commercial producers	___	___	___
l) U.S. commercial producers	___	___	___
m) U.S. educational producers	___	___	___
n) Other	___	___	___

Please specify:

8. How is programming distributed? Please indicate the approximate proportion of curriculum materials drawn from each of the following sources.

a) Provincial centre	___ %
b) School boards/districts/divisions, etc.	___ %
c) Own college resource centre or library	___ %
d) Other college(s) resource centre or library	___ %
e) Off-air broadcasting	___ %
f) Cable distribution	___ %
g) Faculty personal holdings	___ %
h) Directly from commercial source	___ %
i) Other	___ %

Please specify:

9. Does your college have established curricula for students in media awareness or media literacy?

Yes	No	Don't Know
___	___	___

If yes, what proportion of full-time students are exposed to these curricula?

10. Has your college conducted or are you aware of any major research or evaluation studies regarding the role of these technologies as teaching/learning resources?

Yes	No	Don't Know
___	___	___

If yes, please indicate the name of the researcher and the title of the study.

11. Has your college given consideration to new approaches to the use of any or all of the above technologies in teaching and learning?

Yes	No	Don't Know
___	___	___

If so, please describe.

12. Please describe briefly the most prevalent forms, if any, of pre-service and in-service training for your college's instructors in utilizing the above technologies in their teaching.

PART II

1. Does your college have any policies, initiatives or guidelines regarding the introduction and utilization of computer technology as a teaching/learning tool for college level education?

	Yes	No	Don't Know
In classroom	___	___	___
Distance education	___	___	___

If yes, please describe briefly the main elements.
If no, is your college now developing such policies, initiatives or guidelines?

Yes	No	Don't Know
___	___	___

Please elaborate.

2. Please indicate the courses or programmes - other than computer-related subjects or programmes - in which computers are used as a teaching/learning tool at your college.

3. Does your college offer courses or programmes about any of the following computer applications?

	Yes	No
Computer awareness/computer literacy/ computers in society	___	___
Computer technology	___	___
Computer business applications	___	___
Computer applications in small business administration	___	___
Computer-assisted design/computer-assisted manufacturing (CAD/CAM)	___	___
Other	___	___
Please specify:		

4. Please estimate what percentage of your students will have used a computer at the college for at least five hours during the academic year:

1982-83	___ %
1984-85	___ %
1988-89	___ %

5. Please estimate the number of microcomputers in use for teaching/learning purposes in your college.

Commodore	___
Apple	___
TRS-80	___
Other	___
Please specify: _____	
TOTAL	___

6. In your view, will computers have a positive or negative impact on opportunities for equal access to education?

Positive	Negative	Don't Know
___	___	___

Please elaborate.

7. In your view, will computers de-emphasize the use of physical plants for college education?

Yes	No	Don't Know
___	___	___

8. Some instructors have suggested that all students should have easy access to a computer. In your view, what should be the ratio of microcomputer or computer terminals per college student?

How long would you estimate it will be before this amount of equipment is available in your college?

9. Does your province have policies, initiatives, and/or guidelines regarding the purchasing, introduction, utilization, and distribution of computer hardware and software? Please describe.

10. Where is computer software for college courses being produced? (Please check all that apply.)

	Yes	No	Don't Know
In-college production	___	___	___
Provincial ministry	___	___	___
Ministries in other provinces	___	___	___
Universities	___	___	___
Canadian educational communications authorities	___	___	___
Canadian commercial producers	___	___	___
U.S. educational producers	___	___	___
Computer manufacturers	___	___	___
U.S. clearinghouses	___	___	___

11. How is software being distributed to college instructors? Please indicate the approximate proportion of courseware drawn by your college from each of the following sources.

a) A provincial centre ___
b) Own college resource centre or library ___
c) Other college resource centre or library ___
d) Faculty personal holdings ___
e) Other ___
Please specify:

12. Is your college involved in setting up or planning to set up:

	Yes	No	Don't Know
a) Major courseware production	___	___	___
b) Courseware clearinghouses	___	___	___
c) Courseware cataloguing	___	___	___
d) Courseware evaluation	___	___	___
e) Other similar activity	___	___	___

Please specify:

If yes, please describe, indicating also for what subjects and programmes.

13. Has your college conducted or been the subject of any research or evaluation studies of computers in education?

Yes	No	Don't Know
___	___	___

If yes, please indicate the name of the researcher and the title of the study.

14. (a) Is your college involved in the development or application of any of the following technologies?

	Yes	No	Don't Know
a) Telidon - videotex format	___	___	___
b) Telidon - teletext format	___	___	___
c) Videodiscs	___	___	___
d) Communications satellite	___	___	___
e) Teleconferencing (audio/ video/computer)	___	___	___
f) Interactive cable	___	___	___
g) Other	___	___	___

Please specify:

(b) If not, is your college considering becoming involved in any of these technologies?

Yes	No	Don't Know
___	___	___

Please specify:

(c) Are there any projects in your college that combine these technologies with each other or with your computer systems? Please describe.

15. Does your college have facilities for on-line searching of databases?

Yes	No	Don't Know
___	___	___

If so, what databases are you using?

16. In your experience has a need appeared for changing curriculum to put greater emphasis on the following:

	Yes	No	Don't Know
a) Quantitative reasoning and skills	___	___	___
b) Coping with accelerated rates of change	___	___	___
c) An understanding of the causes of political, social and economic change	___	___	___
d) Technology literacy	___	___	___
e) Other	___	___	___

Please specify:

If yes, please describe.

17. Has your college initiated any curriculum changes to put greater emphasis on the following:

	Yes	No	Don't Know
a) Quantitative reasoning and skills	___	___	___
b) Coping with accelerated rates of change	___	___	___
c) An understanding of the causes of political, social and economic change	___	___	___
d) Technology literacy	___	___	___
e) Other	___	___	___

Please specify:

If yes to any of the above, please elaborate.

18. What changes in college education might follow the present invasion of new information technologies and in particular of computers?

19. What strategies, practical accommodations, organizational changes, and physical plant alternatives might your college need to adopt in order to take full advantage of the computer as a teaching device?

20. How will your college address the problem of appropriate courseware?

21. What influences will the potential revolutionary changes caused by these technologies have on the direction of liberal education, general interest studies?

APPENDIX II

List of Responding Colleges

NEWFOUNDLAND

- Bay St. George Community College, Stephenville
- College of Fisheries, Navigation, Marine Engineering and Electronics, St. John's
- Newfoundland and Labrador College of Trades and Technology, St. John's

NOVA SCOTIA

- Nova Scotia Agricultural College, Truro
- Nova Scotia Institute of Technology, Halifax
- Nova Scotia Land Survey Institute, Lawrencetown
- Nova Scotia Nautical Institute, Halifax
- University College of Cape Breton, Sydney

NEW BRUNSWICK

- Collège Nouveau Brunswick de Bathurst, Bathurst
- Collège Nouveau Brunswick Campus de Campbellton, Campbellton
- Collège Nouveau Brunswick d'Edmundston, Edmundston
- New Brunswick Community College, Saint John
- New Brunswick Community College, Woodstock
- New Brunswick Craft School, Fredericton
- School of Medical Laboratory Technology, Saint John

PRINCE EDWARD ISLAND

- Holland College, Charlottetown

QUEBEC - English

- Champlain Regional College, Sherbrooke
- Dawson College, Montreal
- John Abbott College, Ste-Anne-de-Bellevue
- Marianopolis, Montreal

QUEBEC - French

- Campus Notre-Dame-De Foy, Cap-Rouge
- Cégep de Sept-Îles, Sept Îles
- Cégep du Vieux Montréal, Montréal
- Cégep de Saint-Laurent, Ville St.-Laurent
- Collège André-Grasset, Montréal
- Collège André-Laurendeau, Lasalle
- Collège Bois-de-Boulogne, Montréal
- Collège Merici, Québec
- Collège d'Alma, Alma
- Collège de Chicoutimi, Chicoutimi
- Collège de Drummondville, Drummondville
- Collège de Joliette, Joliette
- Collège Lévis, Lévis

Collège de Lévis-Lauzon, Lauzon
Collège de Limoilou, Québec
Collège de Matane, Matane
Collège de l'Outaouais, Hull
Collège de Sainte-Foy, Sainte-Foy
Collège de Saint Jérôme, St-Jérôme
Collège de Saint-Laurent, Ville St-Laurent
Collège de Secrétariat Notre-Dame, Montréal
Collège de Shawinigan, Shawinigan
Collège de Sherbrooke, Sherbrooke
Collège de Victoriaville, Victoriaville
Collège Laflèche, Trois-Rivières
Collège Lionel-Groulx, Ste-Thérèse
Collège Marie-Victorin, Montréal
Collège Montmorency, Ville de Laval
Collège St-Jean-Vianney, Montréal
Institut Teccart Inc., Montréal

ONTARIO

Algonquin College of Applied Arts and Technology, Nepean
Collège Cambrian, Sudbury
Canadore College of Applied Arts and Technology, North Bay
Centennial College of Applied Arts and Technology, Scarborough
Conestoga College of Applied Arts and Technology, Kitchener
Confederation College of Applied Arts and Technology, Thunder Bay
Durham College of Applied Arts and Technology, Oshawa
Fanshawe College of Applied Arts and Technology, London
Georgian College of Applied Arts and Technology, Barrie
Humber College of Applied Arts and Technology, Rexdale
Lambton College of Applied Arts and Technology, Sarnia
Loyalist College of Applied Arts and Technology, Belleville
Mohawk College of Applied Arts and Technology, Hamilton
Niagara College of Applied Arts and Technology, Welland
Northern College of Applied Arts and Technology, South Porcupine
St. Clair College of Applied Arts and Technology, Windsor
Sault College of Applied Arts and Technology, Sault Ste. Marie
Seneca College of Applied Arts and Technology, North York
Sheridan College of Applied Arts and Technology, Oakville
Sir Sanford Fleming College of Applied Arts and Technology, Peterborough

MANITOBA

Assiniboine Community College, Brandon
Keewatin Community College, The Pas
Red River Community College, Winnipeg

SASKATCHEWAN

Carlton Trail Community College, Humboldt
Cypress Hills Community College, Swift Current
Kelsey Institute of Applied Arts and Science, Saskatoon
Mistikwa Community College, North Battleford
Natonum Community College, Prince Albert
Parkland Community College, Melville
Prairie West Community College, Biggar
Saskatchewan Technical Institute, Moose Jaw
Saskatoon Region Community College, Saskatoon
Wascana Institute of Applied Arts and Sciences, Regina
Westside Community College, Beauval

ALBERTA

Fairview College, Fairview
Grande Prairie Regional College, Grande Prairie
Grant MacEwan Community College, Edmonton
Keyano College, Fort McMurray
Lakeland College, Lloydminster
Lethbridge Community College, Lethbridge
Mount Royal College, Calgary
Northern Alberta Institute of Technology, Edmonton
Olds College, Olds
Southern Alberta Institute of Technology, Calgary

BRITISH COLUMBIA

British Columbia Institute of Technology, Burnaby
Camosun College, Victoria
Capilano College, North Vancouver
Cariboo College, Kamloops
Douglas College, New Westminster
East Kootenay Community College, Cranbrook
Fraser Valley College, Chilliwack
Kwantlen College, Surrey
Malaspina College, Nanaimo
Northern Lights College, Dawson Creek
Okanagan College, Kelowna
Open Learning Institute, Richmond
Pacific Marine Training Institute, North Vancouver
Pacific Vocational Institute, Burnaby
Selkirk College, Castlegar